

WHAT IS CLAIMED IS:

1. A thin film transistor comprising:

an island-shaped semiconductor film and an island-shaped gate insulating film patterned by using the same photomask over an insulating substrate;

a side wall made of an insulating material formed on a side face of the island-shaped semiconductor film; and

a gate electrode formed over the island-shaped gate insulating film,

characterized in that the gate electrode overlaps the side face of the island-shaped semiconductor film with the side wall therebetween.

2. A thin film transistor comprising:

an island-shaped semiconductor film and an island-shaped gate insulating film patterned by using the same photomask over an insulating substrate;

a side wall made of an insulating material formed on side faces of the island-shaped semiconductor film and the island-shaped gate insulating film; and

a gate electrode formed over the island-shaped gate insulating film,

characterized in that the gate electrode overlaps the side face of the island-shaped semiconductor film with the side wall therebetween.

3. A thin film transistor comprising:

an island-shaped semiconductor film and an island-shaped gate insulating film

patterned by using the same photomask on an insulating surface; and

a gate electrode formed over the island-shaped gate insulating film,

characterized in that a side face of the island-shaped semiconductor film is insulated, and

the gate electrode overlaps with the insulated side face of the island-shaped semiconductor film.

4. A thin film transistor comprising:

an island-shaped semiconductor film and an island-shaped gate insulating film patterned by using the same photomask on an insulating substrate;

an insulating film patterned to cover side faces of the island-shaped semiconductor film and the island-shaped gate insulating film and only a peripheral portion of a top face of the island-shaped gate insulating film; and

a gate electrode formed over the island-shaped gate insulating film,

characterized in that the gate electrode overlaps the side face of the island-shaped semiconductor film with the insulating film patterned to cover the side faces of the island-shaped semiconductor film and the island-shaped gate insulating film and only the peripheral portion of the top face of the island-shaped gate insulating film therebetween.

5. A thin film transistor according to claim 1 or 2, characterized in that effective thickness of the side wall in a portion covering the side face of the island-shaped semiconductor film in a direction perpendicular to the side face is set equal to or thicker

than effective thickness of the island-shaped gate insulating film.

6. A thin film transistor according to claim 3, characterized by regarding effective thickness of an insulated portion of the side face of the island-shaped semiconductor film in a direction perpendicular to the side face as being set equal to or thicker than effective thickness of the island-shaped gate insulating film.

7. A thin film transistor according to claim 4, characterized by regarding effective thickness of the insulating film patterned to cover the side faces of the island-shaped semiconductor film and the island-shaped gate insulating film and only the peripheral portion of the top face of the island-shaped gate insulating film as being set equal to or thicker than effective thickness of the island-shaped gate insulating film.

8. A method for manufacturing a thin film transistor, characterized by comprising:
forming a semiconductor film over an insulating substrate;
forming a first insulating film over the semiconductor film;
heat-treating the semiconductor film and the first insulating film;
patterning the semiconductor film and the first insulating film into island shapes with the use of the same photomask after the heat treatment to form an island-shaped semiconductor film and an island-shaped gate insulating film;
forming a second insulating film over the island-shaped gate insulating film;
etching the second insulating film anisotropically to form a side wall covering side

faces of the island-shaped semiconductor film and the island-shaped gate insulating film in self-aligned manner;

forming a conductive film over the island-shaped gate insulating film after forming the side wall; and

patterning the conductive film to form a gate electrode.

9. A method for manufacturing a thin film transistor, characterized by comprising:

forming a semiconductor film over an insulating substrate;

forming an insulating film over the semiconductor film;

heat-treating the semiconductor film and the insulating film;

patterning the semiconductor film and the insulating film into island shapes with the use of one resist mask after the heat treatment to form an island-shaped semiconductor film and an island-shaped gate insulating film;

insulating a side face of the semiconductor film by adding oxygen or nitrogen to a side face of the island-shaped semiconductor film without removing the resist mask;

forming a conductive film over the island-shaped gate insulating film; and

patterning the conductive film to form a gate electrode.

10. A method for manufacturing a thin film transistor, characterized by comprising:

forming a semiconductor film over an insulating substrate;

forming a first insulating film over the semiconductor film;

heat-treating the semiconductor film and the first insulating film;

patterning the semiconductor film and the first insulating film into island shapes with the use of the same photomask after the heat treatment to form an island-shaped semiconductor film and an island-shaped gate insulating film;

forming a second insulating film over the island-shaped gate insulating film;

patterning the second insulating film to cover edge portions of the island-shaped semiconductor film and the island-shaped gate insulating film and only a peripheral portion of a top face of the island-shaped gate insulating film;

forming a conductive film over the island-shaped gate insulating film; and

patterning the conductive film to form a gate electrode.

11. A method for manufacturing a thin film transistor, characterized by comprising:

forming a semiconductor film over an insulating substrate;

forming a first insulating film over the semiconductor film;

forming a first conductive film over the first insulating film;

heat-treating the semiconductor film, the first insulating film, and the first conductive film,

patterning the semiconductor film, the first insulating film, and the first conductive film into island shapes with the use of the same photomask after the heat treatment to form an island-shaped semiconductor film, an island-shaped gate insulating film, and a first island-shaped conductive film;

forming a second insulating film over the first island-shaped conductive film;

etching the second insulating film anisotropically to form a side wall covering side faces of the island-shaped semiconductor film, the island-shaped gate insulating film, and the first island-shaped conductive film in a self-aligned manner;

forming a second conductive film over the first island-shaped conductive film after forming the side wall; and

patterning the first island-shaped conductive film and the second conductive film to form a gate electrode.

12. A method for manufacturing a thin film transistor, characterized by comprising:

forming a semiconductor film over an insulating substrate;

forming an insulating film over the semiconductor film;

forming a first conductive film over the insulating film;

heat-treating the semiconductor film, the insulating film, and the first conductive film;

patterning the semiconductor film, the insulating film, and the first conductive film into island shapes with the use of the same resist mask after the heat treatment to form an island-shaped semiconductor film, an island-shaped gate insulating film, and a first island-shaped conductive film;

adding oxygen or nitrogen to a side face of the island-shaped semiconductor film without removing the resist mask to insulate a side face of the semiconductor film;

forming a second conductive film over the first island-shaped conductive film; and
patterning the first island-shaped conductive film and the second conductive film
to form a gate electrode.

13. A method for manufacturing a thin film transistor, characterized by
comprising:

forming a semiconductor film over an insulating substrate;
forming a first insulating film over the semiconductor film;
forming a first conductive film over the insulating film;
heat-treating the semiconductor film, the first insulating film, and the first
conductive film;

patterning the semiconductor film, the first insulating film, and the first conductive
film into island shapes with the use of the same photomask after the heat treatment to form
an island-shaped semiconductor film, an island-shaped gate insulating film, and a first
island-shaped conductive film;

forming a second insulating film over the first island-shaped conductive film;
patterning the second insulating film to cover edge portions of the island-shaped
semiconductor film, the island-shaped gate insulating film, and the first island-shaped
conductive film and only a peripheral portion of a top face of the first island-shaped
conductive film;

forming a second conductive film over the island-shaped gate insulating film; and
forming a gate electrode by patterning the first conductive film and the second

conductive film.

14. A method for manufacturing a thin film transistor according to any one of claims 8, 10, 11 and 13, characterized in that the heat-treatment of the semiconductor film and the first insulating film is done at a temperature of from 600 °C to 800 °C.

15. A method for manufacturing a thin film transistor according to claim 9 or 12, characterized in that the heat-treatment of the semiconductor film and the insulating film is done at a temperature of from 600 °C to 800 °C.

16. A method for manufacturing a thin film transistor according to claim 14, characterized in that a strain point of the insulating substrate is equal to or lower than 600 °C.

17. A method for manufacturing a thin film transistor according to claim 15, characterized in that a strain point of the insulating substrate is equal to or lower than 600 °C.

18. A method for manufacturing a thin film transistor according to claim 9, characterized in that the gate electrode is led outside the island-shaped semiconductor film.

19. A method for manufacturing a thin film transistor according to claim 10,

characterized in that the gate electrode is led outside the island-shaped semiconductor film.

20. A method for manufacturing a thin film transistor according to claim 11, characterized in that the gate electrode is led outside the island-shaped semiconductor film.

21. A method for manufacturing a thin film transistor according to claim 12, characterized in that the gate electrode is led outside the island-shaped semiconductor film.

22. A method for manufacturing a thin film transistor according to claim 13, characterized in that the gate electrode is led outside the island-shaped semiconductor film.

23. An electronic apparatus comprising the thin film transistor according to any one of claim 1 to 4,

characterized in that the electronic apparatus is selected from the group consisting of a light emitting device, a digital still camera, a personal computer, a mobile computer, an image reproducing device, a goggle type display, a video camera, and a cellular phone.